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(71) Applicant *(for all designated States except US)*: **KONINKLIJKE PHILIPS ELECTRONICS N.V.** [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **WOOD, Karl, J.** [GB/GB]; c/o Philips Intellectual Property & Standards, Cross Oak Lane, Redhill, Surrey RH1 5HA (GB). **OWLETT, Timothy, S.** [GB/GB]; c/o Philips Intellectual Property & Standards, Cross Oak Lane, Redhill, Surrey RH1 5HA (GB). **MORRIS, Octavius, J.** [GB/GB]; c/o Philips Intellectual Property & Standards, Cross Oak Lane, Redhill. Surrey RH1 5HA (GB).

(74) Agent: **WILLIAMSON, Paul, L.**, c/o Philips Intellectual Property & Standards, Cross Oak Lane, Redhill, Surrey RH1 5HA (GB).

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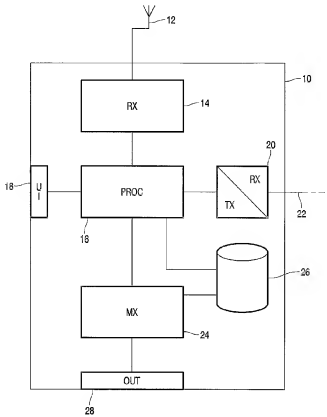
(54) Title: REPAIRING BROADCAST DROPOUT



(57) Abstract: Apparatus for repairing a broadcast signal comprises a receiver for receiving the broadcast signal via a first communication channel, the first communication channel being a wireless broadcast channel. The apparatus further includes a processor for monitoring the broadcast signal to ascertain when the signal is corrupted, a transceiver for requesting via a second communication channel replacement portions and for receiving the replacement portions, and a multiplexor for combining the replacement portions with the received broadcast signal.

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DESCRIPTION

REPAIRING BROADCAST DROPOUT

This invention relates to a method of and apparatus for repairing a broadcast signal.

Television broadcast of video and audio to multiple recipients is typically provided by wireless transmission or satellite broadcast. The signal that is broadcast has traditionally been an analogue signal, but this is now being replaced by digital broadcast of the video and audio, the digital signal also including a data component. Digital broadcast is perceived to have a number of advantages over analogue transmission, principally that more channels can be broadcast for a given portion of the radio spectrum, when compared to the analogue system. Additionally, by having a separate data portion, greater flexibility is also achieved in the amount and type of data that can be transmitted to the receiving device. In the analogue system, teletext is coded with an unused portion of the video signal, with a relative limited functionality.

However, satellite television broadcasts can be disrupted by such things as rain (not uncommon in the United Kingdom) and therefore suffer from dropouts, in the form of temporary corruption of the video and/or audio. Dropouts caused by rain, or birds are annoying and a disincentive to switch from traditional, more rugged analogue broadcasts. Similar problems can be expected with digital terrestrial television, the system whereby a digital broadcast is made from a wireless transmitter at ground level to a traditional television aerial.

It is an object of the invention to provide a method of repairing the broadcast signal, to improve the quality of the signal that is available to the end user.

According to a first aspect of the present invention, there is provided a method of repairing a broadcast signal comprising receiving the broadcast

signal via a first communication channel, wherein the first communication channel is a wireless broadcast channel, monitoring the broadcast signal to ascertain when the signal is corrupted, requesting via a second communication channel replacement portions, receiving the replacement portions, and combining the replacement portions with the received broadcast signal.

According to a second aspect of the present invention, there is provided apparatus for repairing a broadcast signal comprising a receiver for receiving the broadcast signal via a first communication channel, wherein the first communication channel is a wireless broadcast channel, a processor for monitoring the broadcast signal to ascertain when the signal is corrupted, a transceiver for requesting via a second communication channel replacement portions and for receiving the replacement portions, and a multiplexor for combining the replacement portions with the received broadcast signal.

Owing to the invention it is possible to acquire those portions of the broadcast signal that have been corrupted and to repair the broadcast signal with the replacement portions.

Advantageously, the apparatus further comprises a user interface device and an output device. The user interface allows the user to control aspects of the operation of the apparatus, such as whether to output the combined signal or the broadcast signal, according to a received user input.

Preferably, the apparatus further comprises a storage device, the storage device being a simultaneous read/write device. The storage device can store the broadcast signal and the combined signal.

Advantageously, the second communication channel is a fixed line back channel. The requesting via the second communication channel of replacement portions comprises requesting video and audio portions of the broadcast signal that have been corrupted, although the request for the video portions can be a request for only a partial resend of the corrupted video portions of the broadcast signal, therefore reducing the amount of information that must be resent.

In a preferred embodiment, the apparatus is a hard disk video recorder that can effectively pause live TV, thereby introducing a delay between

broadcast and viewing. Provided that the delay is sufficiently large, a system with access to a fixed line communication channel such as ADSL broadband could determine the duration of any dropout and request the missing program material from a server. This material can then be seamlessly combined with the remaining intact program material to produce a clean program free of dropouts. The system could be abused by requesting sufficient "missing pieces" to reconstruct the broadcast via broadband, but preventative measures are expected to form part of the design of a preferred embodiment.

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a schematic diagram of the apparatus for repairing a broadcast signal, and

Figure 2 is a flow diagram of a method of repairing a broadcast signal.

Figure 1 shows a satellite or terrestrial digital television receiver 10 (cable is not affected by the weather) for receiving a digital video and audio stream. The stream is received via a first communication channel, the first communication channel being a wireless broadcast channel, in the form of a broadcast signal, from an aerial 12. The aerial 12 is connected to a receiver 14 for receiving the broadcast signal.

A processor 16 is included for, amongst other operations, monitoring the broadcast signal to ascertain when the signal is corrupted. The processor 16 can detect momentary loss of picture or sound in the digital video and audio stream and can define one or more (ideally short duration) intervals over which the picture or sound is lost (frozen, corrupt, or missing altogether). The receiver 10 also includes a user interface device 18 which can inform the user of such things as bad weather conditions, and can give the user the option to repair or ignore dropouts.

The processor 16 can pause the video and audio stream, thereby delaying the video and audio stream, the amount of the delay being programmable. Under the control of the processor 16 is a transceiver 20 that is

for requesting, via a second communication channel 22, replacement portions of the broadcast signal and for receiving the replacement portions. The second communication channel 22 is a fixed line back channel.

The transceiver 20 is for requesting an undamaged copy of the lost video and audio segment via the broadband connection (real-time) or similar, slower, channel such as a dial-up line (non real-time) – henceforth collectively referred to as the broadband connection. The transceiver 20 communicates with a server capable of supplying short video and audio streams (corresponding to the "lost" broadcast equivalents) via the broadband connection.

A multiplexor 24 is provided for combining the replacement portions supplied by the transceiver 20 with the received broadcast signal. The multiplexor 24 is for splicing the "lost" video and/or audio obtained via the broadband connection into the "damaged" video and audio stream. The multiplexor can also perform a partial repair of the video stream (half frame rate, freeze picture) in conjunction with a full repair of the audio stream. This graceful degradation technique reduces the bandwidth across the broadband channel and/or reduces the load on the server supplying the "lost" video and audio via the broadband connection, because audio requires less bandwidth than video.

The receiver 10 further comprises a storage device 26. The storage device 26 is a simultaneous read/write device such as a hard disk drive. The storage device 26 is for storing the broadcast signal and for storing the combined signal. By storing the broadcast signal as it is received, the receiver 10 can splice the replacement portions of the signal with the originally received signal, this task being carried out by the multiplexor 24 which can recall portions of the original signal from the storage device 26 as required.

The receiver 10 further comprises an output device 28, which in the case of an integrated digital television would be a video display device and audio output devices. In a set top box, the output is an RF signal, with the output device simply being a terminal for connecting to a standard analogue television.

The operation of the receiver 10 will now be described in more detail. In the event that bad weather or the like disrupts the decoded video/audio stream, the processor 16, which is monitoring the incoming signal, provides a flag to indicating the corruption of the signal. The flag may "chatter" (go on and off rapidly) under marginal conditions so a filter within the processor 16 is used to cluster and group flag outputs over time to define one or more short intervals during which disruption has occurred.

In a practical embodiment in MPEG 2, for example, each transport stream packet has a flag in its header to indicate if an unrecoverable bit error exists in the current payload. This allows the tracking of errors down to the resolution of the size of a TS packet, which is 188 bytes. Another possibility is referring to the forward error correction indicating that it has been unsuccessful in correcting all the errors in a particular packet as a way of monitoring the corruption of the received broadcast signal.

Although the receiver 10 is arranged to repair dropouts as unobtrusively as possible, an indication is provided for the presence of dropouts and the operation of the repair mechanism. This could be simply an indicator light on the receiver 10 or an indicator could appear briefly on the screen. The presence or absence of these indications is configurable via the user interface 18. It is also possible for the user to configure the automatic repair mechanism to operate unconditionally, to be disabled unconditionally, or to operate or not operate conditional upon the user's response to an indication of dropout. For the purposes of this embodiment, it is henceforth understood that the receiver 10 performs automatic repairs unconditionally.

Each interval as defined by the filter within the processor 16 is converted into a request to the remote server via the broadband connection 22. The server returns the "lost" video and audio stream via the same broadband connection 22. This process takes time, but provided that the delay between reception and display of the broadcast signal is longer than the time taken to obtain the "lost" video and audio segments via the broadband connection 22, the repair can be affected by splicing the video and audio streams together.

The delay between reception and display is programmable. Ideally it is zero, but in bad weather conditions it can be slowly increased under broadcaster control, with the control signals embedded in either the broadcast or sent via the broadband connection 22. Video and audio are momentarily paused to allow a step increase in the delay; this could be done during commercial breaks for example. A crude but effective way to increase the delay is to distract the viewer with an interactive dialogue. Similar means allow the delay to be reduced in good weather conditions.

Graceful degradation can be adopted in place of a full repair. For example, the video may be frozen and only the audio repaired. This requires much less traffic across the broadband link. Only every second or third frame of repaired video could be sent. In effect, the request for the video portions is a request for only a partial resend of the corrupted video portions of the broadcast signal.

Figure 2 summarises the method of operation of the receiver 10. The steps of the method of repairing the broadcast signal comprise receiving 30 the broadcast signal via the first communication channel, wherein the first communication channel is a wireless broadcast channel, monitoring 32 the broadcast signal to ascertain when the signal is corrupted, requesting 34 via a second communication channel 22 replacement portions, receiving 36 the replacement portions, and combining 38 the replacement portions with the received broadcast signal.

The requesting 34 via the second communication channel 22 of replacement portions comprises requesting video and audio portions of the broadcast signal that have been corrupted.

The method also includes the step 40 of outputting a signal. This can be either outputting 40 the combined signal or outputting 40 the broadcast signal according to a received user input. The method further includes the steps of storing 42 the broadcast signal and storing 44 the combined signal.

CLAIMS

1. A method of repairing a broadcast signal comprising receiving the broadcast signal via a first communication channel, wherein the first communication channel is a wireless broadcast channel, monitoring the broadcast signal to ascertain when the signal is corrupted, requesting via a second communication channel replacement portions, receiving the replacement portions, and combining the replacement portions with the received broadcast signal.

2. A method according to claim 1, wherein the second communication channel is a fixed line back channel.

3. A method according to claim 1 or 2, and further comprising outputting the combined signal, according to a received user input.

4. A method according to claim 1 or 2, and further comprising outputting the broadcast signal, according to a received user input.

5. A method according to any preceding claim, and further comprising storing the broadcast signal.

6. A method according to any preceding claim, and further comprising storing the combined signal.

7. A method according to any preceding claim, wherein the requesting via a second communication channel of replacement portions comprises requesting video and audio portions of the broadcast signal that have been corrupted.

8. A method according to claim 7, wherein the request for the video portions is a request for only a partial resend of the corrupted video portions of the broadcast signal.

9. Apparatus for repairing a broadcast signal comprising a receiver for receiving the broadcast signal via a first communication channel, wherein the first communication channel is a wireless broadcast channel, a processor for monitoring the broadcast signal to ascertain when the signal is corrupted, a transceiver for requesting via a second communication channel replacement portions and for receiving the replacement portions, and a multiplexor for combining the replacement portions with the received broadcast signal.

10. Apparatus according to claim 9, and further comprising a storage device.

11. Apparatus according to claim 10, wherein the storage device is a simultaneous read/write device.

12. Apparatus according to claim 9, 10 or 11, wherein the second communication channel is a fixed line back channel.

13. Apparatus according to any one of claims 9 to 12, and further comprising a user interface device.

14. Apparatus according to any one of claims 9 to 12, and further comprising an output device.

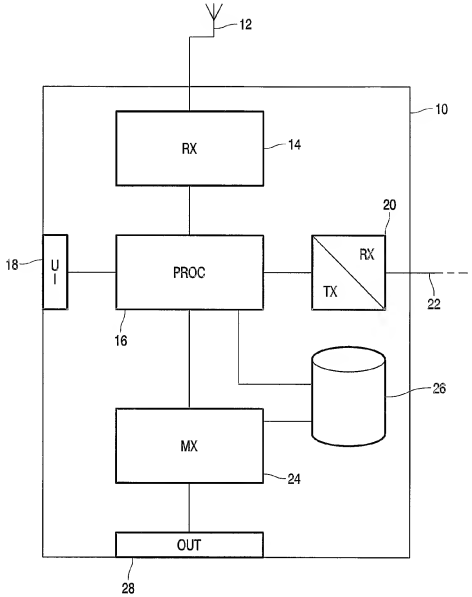

FIG.1

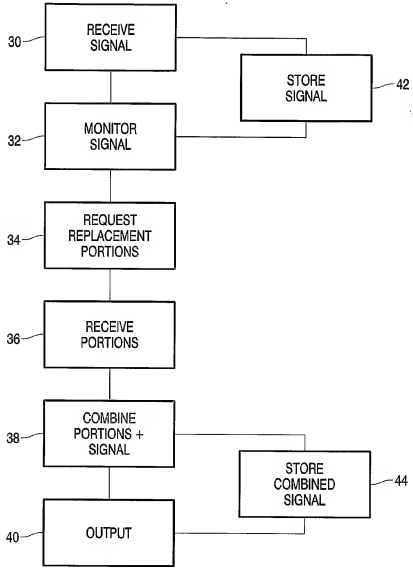
RECEIVE SIGNAL
30
STORE SIGNAL
42
MONITOR SIGNAL
32
REQUEST REPLACEMENT PORTIONS
34
RECEIVE PORTIONS
36
COMBINE PORTIONS + SIGNAL
38
STORE COMBINED SIGNAL
44
OUTPUT
40

FIG.2

INTERNATIONAL SEARCH REPORT

International Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N7/24 H04L1/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N H04L H04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 235 383 A (MATSUSHITA ELECTRIC IND CO LTD) 28 August 2002 (2002-08-28) column 7, line 35 - column 17, line 48	1-14
A	EP 1 274 244 A (MITSUBISHI ELECTRIC CORP) 8 January 2003 (2003-01-08) column 11, line 42 - column 24, line 25	1-14
A	US 5 838 668 A (HIEIDA HIDEKI ET AL) 17 November 1998 (1998-11-17) abstract	1-14
A	US 5 724 345 A (KILLIAN THOMAS JOSEPH ET AL) 3 March 1998 (1998-03-03) abstract	1-14

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 July 2004	02/08/2004

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 02/23791 A (HAARTSEN JACOBUS ;ERICSSON TELEFON AB L M (SE)) 21 March 2002 (2002-03-21) abstract	1-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
/IB2004/001026

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